

Remarks

Claims 1 through 23 were pending in this application. Applicant files a Request for Continuing Examination herewith. The Amendment after final rejection mailed April 14, 2003 has not been entered and is being replaced with this Amendment.

New claims 24 through 36 have been added. Claims 1, 4 and 15 have been amended and no claims have been canceled. The Office has essentially maintained the previous rejections of claims 1, 8, 15 and 18 as anticipated by Niehenke and claims 2-7, 9-14, 16, 17 and 19-23 as obvious over Niehenke in view of Nichols.

Applicant thanks the Examiner for his courtesy in conducting a brief telephone interview with applicant's undersigned representative on or about March 27, 2003. In that conversation, applicant's representative and the Examiner discussed, among other things, the possibility of claiming specific radiation angles in order to distinguish over the prior art and different potential ways of claiming the aspect of the invention claimed in claim 4, wherein the lens completely surrounds the dielectric substrate. Applicant filed an Amendment after final rejection after the interview. The Office subsequently issued an Advisory Action indicating that the Amendment would not be entered and indicating that the Amendment raises new issues, but also further explaining the Office's position with respect to some of the claims.

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In accordance with the telephone interview and Advisory Action, applicant has herein amended the independent claims 1 and 15 to add rotations of specific angles. New and/or dependent claims 25-28 and 30-33, which add further limitations of specific angles and specific gain increases at those angles. Support in the specification for amendments to claims 1 and 15 and new claims 24-33 is found on pages 10 and 11 and in Figures 5A, 5B, 6A, and 6B. Applicant also amended independent claim 1 and 15 responsive to a comment contained in Item 5 of this Advisory Action to expressly recite that the angular relations recited in the claims are measured relative to the patch.

Applicant also has added new claims 34 - 36, which claim the feature of the invention whereby the dielectric substrate is completely surrounded by the lens such that all light reaching the patch passes through the lens. Support for these claims is found in the drawings as well as original claim 4 and page 5, line 10 and page 9, lines 1-2.

Finally, Applicant also added new claims 24 and 29, which add the limitation that the lens is disposed directly on the patch.

The present invention relates to microstrip antennas with improved low angle performance while not diminishing performance closer to the zenith. Particularly, the present invention improves low angle gain of a microstrip antenna primarily by two features of the design. The first feature is a dielectric lens that entirely encapsulates the patch and refracts electromagnetic waves so as to increase the

gain at low angles while not substantially affecting gain at higher angles. The second feature is placing the patch on a second ground plane raised above a first ground plane. The raised, second ground plane further enhances the refraction effect, thereby increasing radiation gain at low angles without diminishing gain at the zenith.

Niehenke discloses in Figure 5 and column 5, lines 35-42 a microstrip antenna comprising an antenna element 114 disposed beneath a focusing lens 142 located in a window 140 of a housing 136. The antenna element 114 comprises a microstrip layer disposed on a substrate 102, which, in turn, is disposed on a ground plane 130.

Applicant has previously argued that claims 1, 8, 15 and 18 patentably distinguish over Niehenke because, contrary to the Office's assertions, Niehenke's lens is positioned well above the patch and is dimensioned and positioned such that it will have no effect on low angle radiation, but will only focus radiation close to the zenith. Particularly, there is no disclosure whatsoever in Niehenke of the purpose, function, effect, or nature of the lens 142. Accordingly, if any assumptions can be made about lens 142 at all, they must be taken from Figure 5 of Niehenke, and it is plainly apparent from the arrangement of cover 138, window 140, and focusing lens 142 shown in Figure 5 that the only radiation that will pass through the lens 142 and strike the patch is radiation very close to the zenith.

In response to this argument, the Office asserted that claim 1 does not preclude the use of a single lens in front of a microstrip patch array in order to focus low angle radiation. The Office further asserted that there would be no reason to focus radiation from the zenith/boresight direction because the cavity structure 138 and its aperture provides a direct "line-of-sight" of the zenith direction. The Office further asserted that absent any additional structure and definition of structure of the lens and antenna, the focused microstrip antenna of Niehenke is applicable in the claimed invention. From this, it appears that the Office's position is that claim 1 does not include enough structural recitation to distinguish over Niehenke and that, in any event, Niehenke inherently discloses low angle radiation gain by use of the lens because "[t]here would be no reason to focus radiation from the zenith/boresight direction because the cavity structure 138 and its aperture provides a direct 'line-of-sight' of the zenith direction."

This is an inaccurate analysis of Niehenke. In fact, there are many situations in which low angle radiation is not a concern and in which focusing energy near the zenith could become a concern. There is nothing to suggest that Niehenke is anything but a system in which the designers were not interested in low angle radiation, but were interested in focusing radiation at or near the zenith. The most telling evidence is Figure 5 itself which clearly shows a lens which can only focus radiation near the zenith. Further, Niehenke shows a 2x2 array of patch elements in the disclosure, which, in fact, suggests that Niehenke is interested in increasing

gain at boresight, not at low angles. Particularly, the use of a 2x2 array in itself is to increase boresight gain and directivity by moving energy away from low angles to the zenith. The elements themselves (114) are under the "lens" (142). The geometric enclosure of the lens over the array of elements is only about $\pm 20^\circ$ from boresight and certainly is not designed to pull energy down to low angles. The lens (142) at the top serves to sharpen the focus of the narrow zenith beam. The lens of the present invention encompasses the entire upper hemisphere of the antenna (in the preferred embodiment) and by its geometry of thickness variation, serves to redirect or "pull" energy down to the horizon and provide more antenna gain at low angles than could be done in the absence of this lens.

Finally, the Office's assertion that there would be no interest in increasing gain at or near the zenith is entirely inaccurate. It seems entirely intuitive that increasing gain in any direction in and of itself could be a legitimate design objective. Further, as previously noted, if anything, the 2x2 array of Niehenke suggests an interest in gain at high angles, not low angles as in the present invention. Thus, the Office's apparent position that Niehenke's lens inherently must be for low angle radiation because no one would be interested in increasing gain for high angle radiation is counterintuitive and false.

Accordingly, claim 1 does, in fact, distinguish over Niehenke. In response to the Advisory Action, which indicated some concern that the independent claim did not recite specific angles, Applicant has added a specific recitation of angle to

independent claims 1 and 15. Even further, applicant has added new claims 25-28 and 30-33 which specifically claim additional specific angles and/or gain increases at specific angles. These claims have been added in accordance with the Examiner's suggestion in the telephone interview of March 27, 2003 that applicant might wish to add more specific limitations regarding the lens structure and functionality. Obviously, there is nothing in Niehenke to suggest these gain increases at these particular angles.

Furthermore, new claims 24 and 29 add that the lens is in direct contact with the patch. The fact that the lens is disposed directly on the patch better provides for very low angle radiation to pass through the lens yet still hit the patch. The feature also is not found in the prior art of record.

In further response to the Examiner's suggestion to add structure to the claims, applicant also has added new claims 34-36 in an attempt to add even more structural limitations concerning the lens. Particularly, claim 4 already recites that the lens completely surrounds the substrate and patch. Claim 34 more specifically recites that the lens is positioned such that all forward radiation that reaches the patch passes through the lens. New claim 35 is similar in scope to claim 4, but depends from independent claim 15. New claim 36 is similar in scope to claim 34, but depends from claims 15 and 35.

Note that the term "forward radiation" has been used in claims 34 and 36 because, although undesirable, all patch antennas also have backward radiation

that emanates down through the substrate and, obviously, therefore does not go through the lens. The undesirable backward radiation is not of concern and applicant certainly does not intend to limit the claims to require that the backward radiation also passes through the lens. In fact, even if it wished to, applicant could not present such claims because they would not find support in the specification (which does not disclose an embodiment in which the lens completely surrounds patch and substrate such that the backward radiation would also go through the lens). Thus, in order to be as accurate as possible, applicant has used the term "forward radiation" in claim 34 (and claim 36). In view of this issue, applicant also has amended claim 4 for purposes of clarifying the term "completely surrounds." Claim 4 (and new claim 35, which parallels claim 4) now makes clear that these claims recite that the lens completely surrounds the top of the patch and substrate, not necessarily the entire substrate.

Niehenke clearly does not disclose a lens positioned so that all forward radiation passes through it.

Hence, claims 1, 8, 15, 18 and new claims 24-36 clearly distinguish over Niehenke.

Turning to the obviousness rejections of claims 2-7, 9-14, 16, 17 and 19-23 over Niehenke in view of Nichols, all of the claims distinguish over this combination for the reasons set forth in connection with claim 1. Nichols does not teach a lens and, therefore, obviously cannot teach the elements missing from Niehenke.

Applicant also previously argued that claim 4 further distinguishes over the proposed combination because it recites that "the dielectric lens covers completely

the patch and the dielectric substrate.” In response to this argument, the Office asserted that Nichols “shows the lens completely covering the patch and substrate, as claimed.” However, this argument does not make sense because Nichols does not disclose any lens. Accordingly, it cannot possibly disclose that a lens completely surrounds the substrate and patch. In the aforementioned telephone interview, the Examiner pointed out that he believed that any radome, such as Nichols’ radome, serves some lensing function and, therefore, this limitation could be read on Nichol’s radome.

Applicant strongly traverses this assertion. A radome clearly is not a lens. A radome, by definition, is transparent to radiation. Essentially every antenna has a radome. To assume that all radomes act as lenses is to turn on its head everything designers assume about radomes when designing antennas. Antenna designers design radomes with the assumption that they are transparent to radiation. In fact, Niehenke, itself, clearly demonstrates this fact. Particularly, Niehenke teaches a radome 138 with the lens 142 disposed in a window 140 within the radome. Niehenke clearly believes that a radome is not a lens and that a lens is not a radome, i.e., that a radome and a lens are two different things. Hence, the Office’s assumption in this regard is not supported by the facts.

Furthermore and finally, the Office did not specifically respond to applicant’s argument that the proposed combination of Niehenke and Nichols is improper in any event. Particularly, it is well established that two references cannot properly be combined to formulate an obviousness rejection unless there is a teaching in the prior art suggesting that the references be combined in the manner necessary to

arrive at the claimed invention. No such suggestion exists in the present case. The primary teaching in Nichols that the Office relies upon is the teaching of a second, raised ground plane. However, the purpose of combining the raised ground plane with a lens in the present invention is to further improve low angle gain of the antenna. However, neither of the references, Niehenke and Nichols, has anything to do with improving low angle gain of the antenna and, thus, the references clearly cannot suggest this purpose. Furthermore and in any event, even if Niehenke did deal with the issue of increasing low angle gain, the combination still would be improper. Since Niehenke does not teach a second, raised ground plane, Niehenke obviously does not provide the suggestion of using the raised ground plane. Therefore, the necessary suggestion of the prior art must come from Nichols (or elsewhere). However, Nichols certainly does not mention increasing low angle gain. Accordingly, there does not appear to be any motivation provided in the prior art of record to make the combination. The simple question is why would one, having knowledge of Niehenke and Nichols, be motivated to add the raised ground plane of Nichols to Niehenke. Clearly not to improve low angle gain, since neither reference addresses that topic. The question then is whether there is any other motivation provided in the prior art of record. Certainly, the Office has not yet provided any. Accordingly, the proposed combination and obviousness rejection is *prima facie* unsustainable.

Furthermore, the Office uses Nichols for the secondary purpose of showing a lens completely surrounding the antenna. This is based on the erroneous

assumption (as discussed above) that a radome is a lens. However, if the Office's position that Nichols' radome is a lens were to be taken as accurate, then even more clearly, the proposed combination of Niehenke and Nichols would be improper for this secondary purpose because the primary reference, Niehenke, clearly teaches away from the assertion that a radome is a lens. Specifically, as noted above, Niehenke clearly teaches that a radome is not to be considered a lens. Furthermore, certainly nothing in Nichols suggests that he considers his radome a lens. Therefore, even if we were to consider the possibility that the Office's assertion that a radome is a lens was accurate, Niehenke disagrees with the Office. And it is impossible to reconcile these two alleged pieces of prior art in a way such that it would be reasonable to find a suggestion in the art to make the proposed combination. In this situation, in order for the combination to be suggested in the prior art, one must have some reason to assume that one of ordinary skill in the art would ignore the teachings of the primary reference itself. Applicant cannot see how this could be possible, except through the use of improper hindsight in view of the present invention.

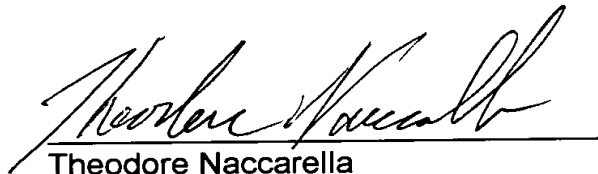
Hence, in addition to all of the actual distinctions over the proposed combination discussed above, the proposed combination itself is not even proper.

The Commissioner is hereby authorized to charge any additional fees or credit any overpayment associated with this communication to Deposit Account No. 19-5425.

In view of the foregoing amendments and remarks, this application is now in condition for allowance. Applicant respectfully requests the Examiner to issue a Notice of Allowance at the earliest possible date. The Examiner is invited to contact Applicant's undersigned counsel by telephone call in order to further the prosecution of this case in any way.

Respectfully submitted,

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